

to include the copy is recognized to be identical to the data configured to include the identified some data. This is a process of ensuring whether the creation of copy is achieved by the number of the deleted duplicated data.

[0113] In the above-mentioned example, when the duplicated data of the region 920 of the logical region 503 of the node W (501) is deleted, the control unit 140 may generate a copy of the data of the region 910 of logical region 539 of the node Z (531). Thus, the control unit 140 may check whether the generated copy constitutes the data 800 of FIG. 8 by making a pair with the duplicated data stored in the regions 920, 940, 960 and 980. For the checking, the control unit 140 may determine whether the result of combining some data of the regions 910, 930, 950 and 970 coincides with the result of combining the copy with the duplicated data stored in the regions 920, 940, 960 and 980.

[0114] The control unit 140 may determine the number of the data, in which the identity is recognized as a result of determination, as the value of replication factor of the data. In the above-mentioned example, when the identity is recognized, the control unit 140 may determine the value of replication factor as 1.

[0115] This is a process for recovering the data stored in the memory 110 in a state of data before deletion of the duplicated data. The control unit 140 may perform control so that the recovered data is re-balanced in a state in which the storage space is added to the memory 110.

[0116] Even though the duplicated data is deleted in step (S1205), in some cases, the utilization rate of the memory 110 may exceed the second threshold value. For example, this is a case where the initial utilization rate of the memory 110 is 95%, and even though the duplicated data is deleted in step (S1205), the utilization rate of the memory 110 is 90%. The control unit 140 may additionally determine whether the utilization rate of the memory 110 is equal to or greater than the second threshold value. As a result of the additional determination, when the utilization rate of the memory 110 is equal to or greater than the second threshold value, the control unit 140 may reduce the value of replication factor of the data. Also, with a decrease in the value of replication factor, the control unit 140 may perform control so that at least one data duplicated with the data is deleted. The description thereof is replaced with the description of FIG. 4.

[0117] Meanwhile, after step (S1205), as a result of additional determination as to whether the utilization rate of the memory 110 is equal to or greater than the second threshold value, when the utilization rate is less than the second threshold value, the control unit 140 may output information about the capacity of the remaining storage space corresponding to the threshold value. That is, the control unit 140 may inform the administrator of the in-memory database about information on the capacity of the remaining storage space of the memory 110 capable of being additionally used to the first threshold value, and the capacity of the remaining storage space of the memory 110 capable of being additionally used to the second threshold value.

[0118] The methods according to the embodiment of the present invention described with reference to the accompanying drawings may be performed by execution of a computer program that is achieved by the computer-readable code. The computer program may be transmitted from the first computing device to the second computing device through a network such as Internet and may be installed on

the second computing device, and thus, the computer program may be used in the second computing device. The first computing device and the second computing device includes all of a fixed computing device such as a server device and a desktop PC, and a mobile computing device such as a laptop computer, a smart phone and a tablet IPC.

[0119] The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although a few embodiments of the present invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the embodiments without materially departing from the novel teachings and advantages of the present invention. Accordingly, all such modifications are intended to be included within the scope of the present invention as defined in the claims. Therefore, it is to be understood that the foregoing is illustrative of the present invention and is not to be construed as limited to the specific embodiments disclosed, and that modifications to the disclosed embodiments, as well as other embodiments, are intended to be included within the scope of the appended claims. The present invention is defined by the following claims, with equivalents of the claims to be included therein.

[0120] While the present invention has been particularly illustrated and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the present invention as defined by the following claims. The exemplary embodiments should be considered in a descriptive sense only and not for purposes of limitation.

What is claimed is:

1. A method for managing data using an in-memory database that is executed by a database management apparatus, the method comprising:

first determining whether a first memory utilization rate is equal to or greater than a threshold value;

in response to the first determining determines that the first memory utilization rate is equal to or greater than the threshold value, reducing a value of replication factor of data stored in the memory; and

deleting at least one data duplicated with the data stored in the memory, based on the reducing the value of replication factor.

2. The method of claim 1, wherein the deleting at least one data duplicated with the data comprises:

second determining after deleting the at least one duplicated data, whether the first memory utilization rate is equal to or greater than the threshold value; and

in response to the second determining determines that first the memory utilization rate is equal to or greater than the threshold value, additionally reducing the reduced value of replication factor.

3. The method of claim 1, wherein the deleting at least one data duplicated with the data comprises:

storing at least one deleted duplicated data in a preset storage space other than the memory.

4. The method of claim 1, wherein the first determining whether the memory utilization rate is equal to or greater than the threshold value comprises:

in response to first determining determines that the first memory utilization rate is equal to or greater than the